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DOI: https://doi.org/10.1080/1461670X.2021.1889395

Journalism Studies

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rjos20

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To cite this article: Ines Engelmann, Simon M. Luebke & Sabrina H. Kessler (2021) Effects of News Factors on Users' News Attention and Selective Exposure on a News Aggregator Website, Journalism Studies, 22:6, 780-798, DOI: 10.1080/1461670X.2021.1889395

To link to this article: https://doi.org/10.1080/1461670X.2021.1889395

JOURNALISM STUDIES
2021, VOL. 22, NO. 6, 780–798
https://doi.org/10.1080/1461670X.2021.1889395

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Taylor & Francis Group

Effects of News Factors on Users' News Attention and Selective Exposure on a News Aggregator Website

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ABSTRACT

Do journalistic relevance criteria still matter in digital news environments where news is selected and aggregated by algorithms? This article investigates how news factors (e.g., conflict, power elite) influence users' news attention and selective exposure on the news aggregator website Google News. Alongside direct effects, the study also examines indirect effects of news factors on users' news selection processes via media cues of news items on the news aggregator website (e.g., picture, position, and recency). The study relies on the news value theory and analyzes observations of users' news attention and selective exposure on Google News via eye tracking ($N = 47$ participants, $N = 751$ news items). We conducted a content analysis on all news items on Google News that users paid attention to. The results show that news factors do not have direct effects on news attention and selective exposure, but rather indirect effects mediated via media cues of news items. Consequently, the traditional idea of newsworthiness based on professional journalistic norms continues to play a role on a news aggregator where news is selected by algorithms.

KEYWORDS

News selection; news attention; news factors; news cues; eye tracking; news aggregator website

The news value theory is one of the most important theories explaining news selection processes by journalists (Galtung and Ruge 1965) and recipients (Eilders 1997, 2006). It specifies news factors as characteristics of events (e.g., degree of conflict as a characteristic of a parliamentary debate) and news values as journalists' and recipients' judgments about the relevance of these characteristics (e.g., the reported degree of conflict) (Eilders 1997, 2006). Scholars have applied the theory to different stages of offline and online selection processes to explain audience members' news relevance attributions (Weber and Wirth 2013), news attention (Lee 2009), news selection (Donsbach 1991; Eilders 1997; Engelmann and Wendelin 2017; Hautzer, Lünich, and Rössler 2012), news retention (Eilders 1997), news participation (Weber 2014), and news multiplication (Hautzer, Lünich, and Rössler 2012; Wendelin, Engelmann, and Neubarth 2017). Preceding journalistic selection processes have also been frequently examined (e.g., Boukes, Jones, and Vliegenthart 2020).

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Supplemental data for this article can be accessed https://doi.org/10.1080/1461670X.2021.1889395

For some years now, audience members' news use has increasingly shifted to the Internet (Newman et al. 2020). Although people still consume most online news from media companies' websites, users also rely on news aggregator websites to search for information. Google News is one of the most common examples for a news aggregator website. Its weekly use has increased in various regions between 2017 and 2019: North America (17%, +4%), EU (17%, +7%), Asia (28%, +7%), and Latin America (41%, +20%) (Newman et al. 2019). People who use a news aggregator seek orientation in a digital news environment in which several providers offer a vast amount of information. However, even news aggregators supply users with a high number of news items from different media outlets. This news is no longer exclusively selected according to professional journalistic criteria, but by nebulous computer algorithms, creating a high-choice news environment for users (Carlson 2018). At the same time, users are only able to process a limited amount of information (Eppler and Mengis 2004).

From a news value perspective, it is unclear whether news factors are still relevant collective selection criteria in contexts where news are algorithmically selected and published. Even in traditional media environments, there is empirical evidence that users not only rely on news factors but also on formal news cues to select news (e.g., Donsbach 1991; Eilders 1997). News cues in traditional mass media are products of journalistic actions, as journalists (un-)intentionally present news with more or stronger news factors in a more prominent or more detailed way. The influence of news cues on users' news selection processes may be even stronger on news aggregators than in traditional media or on online news websites, because users are exposed to a vast amount of information in this high-choice news environment. However, the relationship between these algorithmically driven news cues and professional journalists' relevance criteria has not yet been examined. Thus, our first research question is: to what extent are the news cues used applied by the news aggregator (e.g., the length or position of a news item) influenced by professional journalistic news factors? An analysis of the relationship between news cues on Google News and professional selection criteria by journalists allows us to discuss whether news aggregator websites, in a democratic sense, create conditions allowing users to form an opinion from a broad spectrum of independent and diverse news of collective relevance. This question is also related to concerns in journalism that a possible shift from professional news selection to more commercially driven news selection could undermine the autonomy of journalism.

Second, we investigate to what extent users' news selection processes on a news aggregator are influenced by news factors. There is scant but confirmatory evidence on this question from empirical research (Kessler and Engelmann 2019; Wendelin, Engelmann, and Neubarth 2017), indicating that users also rely on news cues to select relevant news on a news aggregator (e.g., Dellarocas et al. 2015; Sundar, Knobloch-Westerwick, and Hastall 2007). This raises the crucial question of whether users select news based on news factors stemming from professional norms or based on media cues, which are the product of a company's business model for filtering out the most relevant news. If only the latter were true, there would be consequences for democracy, because people would not obtain all the relevant information needed to form an opinion on political issues (Van Aelst et al. 2017). In this scenario, people would form their opinions from less diverse and strongly biased information, selected primarily for its commercial relevance to news providers.

To answer our research questions, we first distinguish between two different news selection processes by users on a news aggregator: News attention, i.e., the amount of time the users spend focusing on news items, and selective exposure, defined as systematic bias towards journalistic relevance (news value) of the news selected by users. Second, we outline the main theoretical assumptions of the news value theory and discuss empirical findings on direct and indirect effects of individual news factors on users' news selection. The study focuses on effects of media-side factors, as opposed to individual-level factors such as users' attitudes and motivations (e.g., Winter, Metzger, and Flanagin 2016). Methodologically, we combine eye tracking data from observed news selection processes on Google News with a content analysis of the news perceived by users.

Theoretical Background

News Selection Processes: Selective Attention and Selective Exposure

Users' news selection involves two different selection processes: news attention and selective exposure to the news (Knobloch-Westerwick 2015). Attention is defined as expending mental effort to process news (see Chaffee and Schleuder 1986). It describes a process by which citizens decide which news aspects they consider worth reading (Kruikemeier, Lecheler, and Boyer 2018). As self-reports often do not provide accurate measures of news attention (Araujo et al. 2016), we apply an observational approach and use objective reading time measures to capture users' attention (Kruikemeier, Lecheler, and Boyer 2018; Wedel and Pieters 2008).

By selective exposure we mean "any systematic bias in selected messages that diverges from the composition of the accessible messages" (Knobloch-Westerwick 2015, 6). This term "does not imply specific biases in or causes for the observed behavior" (Knobloch-Westerwick 2015, 6). The notion of selective exposure corresponds to the second type of selective exposure identified by Stroud (2017), which assumes that people are more likely to select information that they consider to be more relevant. News value theory assumes that these individual relevance criteria are collectively shared and that users are thus more likely to click on relevant news with many or more prominent news factors compared to less relevant news with few or less prominent news factors. Theoretical reasons for this assumption are discussed in the next section. Selective exposure on a news aggregator is associated with clicking on a specific news item and opening a link with the full news article. This click demands more activity by users than selection processes in other media contexts, such as watching a television program or reading a newspaper article. Each click on a news item is considered an active choice of users.

Previous studies show that attention is superior to selective exposure in predicting knowledge acquisition (Chaffee and Schleuder 1986; Kruikemeier, Lecheler, and Boyer 2018; Romantan et al. 2008). But there are hardly any comparative findings on the impact of user motivations on attention and selective exposure. Clicking behavior as one type of selective exposure may vary depending on whether users seek to navigate through the website to get a general orientation ("activity mode") or pursue a specific goal ("goal mode") (e.g., Bucher and Schumacher 2006; Kessler, Mede, and Schäfer 2020). In the first case, users typically observe the current news situation and rarely click on items. In the second case, they purposefully search for specific news and are

more likely to actively click on a news item to obtain further information. This study focuses on the first type of motivation, which is closer to collective relevance attributions assumed by news value theory (see next section) than the second type of motivation, which is more compatible with theoretical explanations taking the informational utility approach (Knobloch-Westerwick 2015). Although methodologists found overlaps between attention and exposure measures (Chaffee and Schleuder 1986; Dellarocas et al. 2015; Romantan et al. 2008), the aforementioned definitions and effects of attention and selective exposure on knowledge suggest a distinction between the two concepts. In the following sections, we outline possible relations of news value research with news attention and selective exposure.

Direct Effects of News Factors on News Selection Processes

Eilders (2006) interprets news factors as relevance indicators applied by journalists and the audience. News factors influence selection processes by journalists and recipients in a similar way. They hardly vary between individuals (based on individual motivations or interests) and are thus considered "collectively shared relevance criteria" (Eilders 2006, 11). Eilders (1997, 2006) links attention with the news value perspective, stating that "the theories on selective attention make it clear that the only reasonable way to reduce complexity is to select the relevant aspects and neglect the irrelevant aspects of information" (13). She suggests two explanations for this assumption: The first is that people assign relevance to things that pose a potential threat to someone's life or well-being (evolutionary argument). The second explanation refers to relevance attributions due to shared socialization (socialization argument): This "kind of relevance can be assigned by members of society if society might be affected, even if the individual itself is not directly affected" (Eilders 2006, 15).

News aggregators provide many parts of news, which, if displayed as search results, often consist only of headlines, pictures, and sometimes small news texts. News containing collective relevance indicators was shown to increase users' attention and selective exposure on a news aggregator (Kessler and Engelmann 2019). Eye tracking research has shown that during the orientation phase (i.e., in the first seconds of a website visit), users divide their attention between the context (e.g., a picture) and the headline of a news item (Bucher and Schumacher 2006). Thus, we examine the impact of four news factors that have empirically proven to be influential for news selection processes in previous media contexts: power elite, prominence, proximity, and conflict.

The news factor *power elite* is associated with powerful persons, organizations, institutions, or nations (Eilders 2006; Galtung and Ruge 1965; Harcup and O'Neill 2017). It refers to the socialization argument, because actions by powerful elites are more likely to have societal consequences than actions by ordinary people (Eilders 1997; Galtung and Ruge 1965). Studies have shown that power elite has an impact on selective exposure to offline and online news (Donsbach 1991; Hautzer, Lünich, and Rössler 2012; Kessler and Engelmann 2019). Power elite is clearly visible in news headlines on a news aggregator if powerful actors (e.g., politicians in government), organizations, institutions (e.g., the government, WHO, NATO) or nations (e.g., US, China) are mentioned. Thus, we assume: *News with power elite increases users' selective attention (H1a) and selective exposure (H2a)*.

The news factor *prominence* involves famous people, regardless of their power and/or position (Eilders 2006; Galtung and Ruge 1965; Harcup and O'Neill 2017). This news factor may signal relevance to users, because actions by well-known (i.e., important) people typically have greater consequences than actions by ordinary people (socialization argument). Empirical research has shown that prominence influences selective exposure in offline (Donsbach 1991; Eilders 1997) and online news contexts (Hautzer, Lünich, and Rössler 2012). Prominence can be displayed in headlines on the news aggregator by naming well-known persons and celebrities, e.g., from sports, film, or television. Accordingly, we assume: *News with prominence increases users' selective attention (H1b) and selective exposure (H2b)*.

Proximity increases the relevance of news because it may be meaningful to many readers in a specific geographical region (socialization argument). Because they are more likely to be affected by itsconsequences, people consider an event as more important if it happens nearby or is connected to their own culture, society, or region (Galtung and Ruge 1965; Harcup and O'Neill 2017). Empirically, proximity has been shown to increase the perceived relevance of an event (Weber and Wirth 2013) and the level of multiplication (Weber 2014). Proximity is indicated in headlines on a news aggregator by naming places, regions or well-known actors nearby. Therefore, we assume: *News with proximity increases users' selective attention (H1c) and selective exposure (H2c)*.

Both theoretical arguments by Eilders apply for the news factor *conflict*. While legal or political resolutions to political conflicts often have social consequences (socialization argument), non-political conflicts, e.g., personal disputes between people are potential threats to someone's well-being (evolutionary argument) (Eilders 1997, 2006; Harcup and O'Neill 2017). Experiments show that conflict increases perceived relevance (Weber and Wirth 2013) and influences users' selective exposure (Engelmann and Wendelin 2017). Studies combining content analyses of news coverage with observations or surveys of recipients confirm the influence of conflict on the audience's selective exposure in offline and online contexts (Donsbach 1991; Eilders 1997; Hautzer, Lünich, and Rössler 2012; Kessler and Engelmann 2019). News aggregators can highlight conflicts as characteristics of events by naming individual, institutional, or state actors with conflicting opinions and/or using conflict-laden terms (e.g., dispute, protest, war). Thus, we propose: *News with conflict increases users' selective attention (H1d) and selective exposure (H2d)*.

Indirect Effects of News Factors on News Selection Processes

The news value theory presumes direct effects of news factors on users' selection processes. Still, empirical research has also found indirect effects in traditional media contexts. It shows that formal presentation features of news articles such as size, placement, and visual elements mediate the relationship between news factors and audience selection processes (Donsbach 1991; Eilders 1997). Thus, the use of various cues represents one way for journalistic media to guide users' attention (Lee 2009). Whether news factors have indirect effects on selection processes on a news aggregator is still an open question. In the next section, we first describe a possible relationship between news cues and users' news selection processes on a news aggregator, then we discuss the relationship between news factors and news cues on a news aggregator.

News Cues and News Selection Processes

People are cognitive misers and do not spend more cognitive effort than necessary to reach a certain inference (Fiske and Taylor 1991). This social-cognitive reasoning for the relevance of news cues was already evident in news contexts before the digital age. However, the advent of Web 2.0 has led to an increased amount of information about different media types and channels, such as news bundles from numerous different information sources by news aggregators. At first glance, news aggregators perform a similar function for users as traditional media. They rank collected news items, display them with news excerpts in greater or lesser detail, and present them with or without pictures. On a news aggregator, however, these cues are primarily determined by programmed computer algorithms and no longer exclusively by journalists' relevance attributions. This also applies to news aggregators' navigational aids and tools, such as source, recency, or related-article cues on Google News (Sundar, Knobloch-Westerwick, and Hastall 2007). These cues guide users "because of the multiplicity of sources embedded in the numerous layers of online dissemination of content" (Sundar 2008, 74). In any case, these news cues are primarily based on media technology and not necessarily on journalistic relevance determinations.

The effects of media cues on attention and clicking outcomes on news aggregators have already been well examined (Dellarocas et al. 2015; Sundar, Knobloch-Westerwick, and Hastall 2007; Xu 2013). Previous research has shown that the presence of a picture and news item length can increase selective attention and click probability (Dellarocas et al. 2015). The related-articles cue affects click probability in a non-linear, inverted u-shaped way (Dellarocas et al. 2015). The recency and source cues are associated with "users' evaluations of information quality and relevance" (Sundar, Knobloch-Westerwick, and Hastall 2007, 368). Thus, recent news gets more attention (Dellarocas et al. 2015; Sundar, Knobloch-Westerwick, and Hastall 2007; Xu 2013). Previous research on the source cue has come to mixed findings (e.g., Metzger, Flanagin, and Medders 2010; Sundar, Knobloch-Westerwick, and Hastall 2007; Xu 2013). Overall, these considerations suggest that the prominence of media cues provided by a news aggregator guides users' relevance attributions (Xu 2013). Thus, we assume that users pay more attention to news and are more likely to select news with prominent news cues (e.g., high position, recent news): *News with prominent news cues increases users' selective attention (H3a) and selective exposure (H3b)*.

Linking News Factors and News Cues for a News Aggregator

Media cues on a news aggregator website such as Google News are not exclusively defined by journalists, but by news aggregators' algorithms, which automatically apply them to news items from diverse news organizations. Therefore, it is crucial to identify the criteria used by algorithms to rank and present news on their websites. To what extent these algorithms rely on journalistic relevance criteria, i.e., news factors and/or their presentation in the form of formal cues, is of particular relevance. This requires knowledge of the selection criteria that influence the algorithmic decisions of news aggregators in general and of Google News in particular. Since this information is kept as a business secret and the algorithms change rather frequently, our reasoning is limited to proposing a plausible relationship.

Even though empirical evidence for this assumption is scarce, it has been stated several times that Google News does not primarily follow journalistic relevance criteria (overview:

Carlson 2018). First, Google News selects news that appears frequently across different websites. However, frequently available news does not necessarily indicate relevance for the public, as its frequency can also be the result of clicks and shares by actors with strategic interests regarding the use or dissemination of information. Second, news aggregators favor more recent news articles. This means that the algorithm disfavors exclusive and usually time-consuming investigative news which are of particular importance for the media's critique and control function as well as for individual and collective opinion formation. Instead, prioritizing up-to-date news leads to the repetition of similar, frequently existing information. Similar phenomena are known in journalism as "journalistic co-orientation" or "pack journalism" (e.g., Krämer, Naab, and Daschmann 2008). Third, Google News mainly provides results from a few large media sources, indicating a popularity bias (e.g., Haim, Graefe, and Brosius 2018).

Still, journalistic news decisions seem to be partially incorporated into the Google News algorithm. While the specific shares remain unclear, the debate between Google News and media organizations on "stealing" journalistic content shows that journalistic relevance criteria are at least indirectly reflected in the news aggregator's algorithm (e.g., Chyi, Lewis, and Zheng 2016). An interview with one of the Google News creators indicates that articles are or were ranked based on originality, freshness (probably referring to news recency), localness, and expertise of the source (Machlis 2009). In particular, the position of a news story on the original news websites seems to be a factor. However, it is unclear whether the position on the source website is itself algorithmically determined to match user interests or results from journalistic decisions. These considerations permit the following assumption: *News items are more likely to include prominent news cues if they contain news factors (H4)*.

News Cues Mediating Between News Factors and Selection Processes

There is solid empirical evidence for the impact of news factors on users' attention and selective exposure. News value research shows that the impact of news factors on selective exposure in traditional mass media (i.e., article usage: at least headline read) is partially mediated by newspapers` layouts (Donsbach 1991). Our previous considerations regarding selection processes on a news aggregator lead in the same direction. According to the third and fourth hypotheses, news factors of news item predict prominent news cues, and the prominence of news cues predicts users' attention and selective exposure to a news item. This implies that news cues mediate the relationship between news factors and attention as well as selective exposure. Thus, the following hypothesis is proposed: *The presence of prominent news cues for a news item mediates the relationship between news factors for this news item and news attention (H5a) as well as selective exposure to this item (H5b)*. All hypotheses are presented in Figure 1.

Method

Design

The study combines an observation of users' news attention and news clicking on Google News via eye tracking with a standardized content analysis of the news items. We coded all news items that users paid selective attention to, regardless of whether or not they also

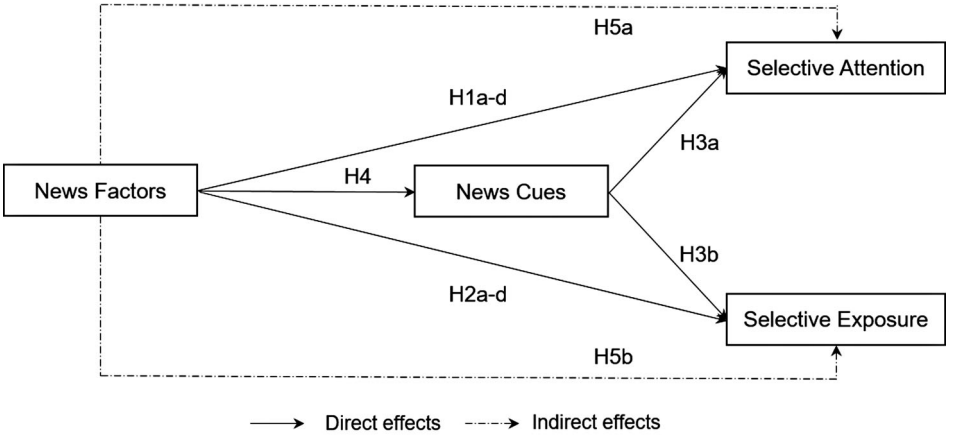

Figure 1. Hypotheses.

clicked on them. The eye tracking data were saved as screenshots and videos for every participant.

The eye tracker (SensoMotoric Instruments [SMI] iView X Red, 120 Hz) shows a person's focus on each news item on Google News in real time by locating their fovea centralis (a small, central pit composed of closely packed cones in the eye). The eye tracker collects data about eye movements and points of focus (Granka, Feusner, and Lorigo 2008). These data allow researchers to make conclusions about eye fixations on the given media stimulus. Fixations are periods when the eye is relatively immobile. They indicate the area where attention is likely to be allocated (Bucher and Schumacher 2006). Therefore, these points of focus reflect users' dwell time on news items and can be interpreted as indicators of selective attention. Such process-tracking data provide a deeper understanding of how users perceive online information (Granka, Feusner, and Lorigo 2008; Kessler, Mede, and Schäfer 2020).

Participants and Procedure

For this study, 47 students ($M_{age} = 23.3$; $SD_{age} = 2.1$; 72% female) were recruited at a German university. The student sample was homogeneous in terms of age and education. About every fourth participant ($n = 11$; 25.5%) stated that he or she had used Google News in the last week. Most participants used online newspapers ($n = 45$, 95.7%) and social networks ($n = 38$; 80.6%) at least twice a week, while fewer users watched TV news ($n = 32$; 68.1%) or read print newspapers ($n = 15$; 32.6%) more than once a week. Since there was only one computer in the researcher's media laboratory equipped with the remote eye tracker and the appropriate software, participants set up individual appointments. Due to low levels of content personalization on news aggregator websites (Haim, Graefe, and Brosius 2018), we expected each participant to see diverse news items in the search results.

When the participants arrived at the media laboratory, the correct focus of each participant's eye was calibrated, and validity was confirmed with the help of the SMI eye tracking software. Correct focus was measured with nine points. The data was within

an acceptable range for all participants, between 0.3 and 0.8 degrees on the x- and y-axes (derivation x and y: $M = 0.48$; $SD = 0.19$). The present study focuses on information seeking with a general orientation, not in response to a specific task (e.g., Bucher and Schumacher 2006; Kessler, Mede, and Schäfer 2020). The participants were asked to obtain an overview of current events. Participants were given time until they clicked on a maximum of five news items during the information search. Because participants were not informed of this limit, they could stop searching once they felt sufficiently informed and before reaching the limit. The decision to limit the number of news results was in line with findings from previous research showing that users check fewer than five search results on average (Pan et al. 2007), and ensured that data quality was not affected by participants' decreasing focus. Google News was set as the home page for the internet browser. The study was conducted over two weeks in February 2015.

Measures

The dependent variables were measured by coding each participant's eye tracking data. The unit of analysis was a news item on Google News to which a participant paid attention. An item may encompass three elements: headline, news text, and picture. A news item should have at least one of these three elements. However, Google News changed the design of its website in June 2017 "to make news more accessible and easier to navigate" (Google Blog 2017). Figures 2 and 3 show the old design on which the study was based. Reliability was calculated by the average pairwise intercoder agreements (*PAs*) using Holsti's method and Krippendorff's alpha (α), applying the SPSS macro by Hayes and Krippendorff (2007). Definitions, descriptive statistics, and reliability values of all variables are reported in Appendix 2.

The dependent variables—news attention and selective exposure to a news item—were tracked by the eye tracking software. News attention was operationalized by the dwell time. This behavioral measure has some advantages compared to other measurement strategies (Araujo et al. 2016; Chaffee and Schleuder 1986). Eye tracking is an observational approach that allows for recording gaze behavior within users' selection processes on a news aggregator under natural conditions (Wedel and Pieters 2008). The eye movements recorded by the eye tracker are seen as a perceptual indicator of attention (Wedel and Pieters 2008). Dwell time based on these eye movements for each news item is composed of characteristics of the news item and the user. Since the

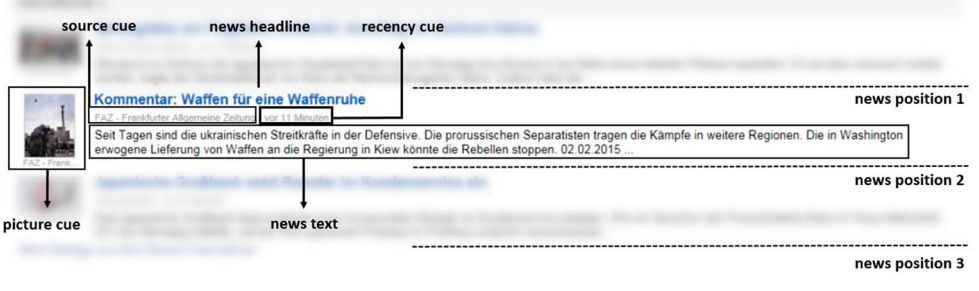

Figure 2. Design of a news item on Google News without related articles before June 2017.

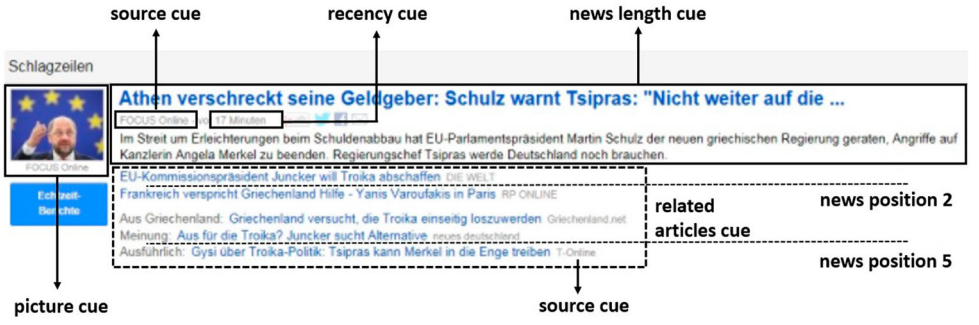

Figure 3. Design of a news item on Google News with related articles before June 2017.

influence of personal characteristics is not of interest here, variance on the individual level was eliminated (Appendix 2). News items were only included when they obtained a dwell time of at least one millisecond. News items without dwell time were excluded, because the characteristics of these news items cannot affect users' attention. The dwell time variable still has strong variance (Appendix 2).

Selective exposure is understood as an overt action, in our case a choice for or against clicking on a news item with more or less collective relevance (news value) (Knobloch-Westerwick 2015). The overt clicking action on news items as an indicator for selective exposure was also recorded by the eye tracking software, but is not necessarily related to eye movements. Participants' further reading and clicks on news websites other than Google News were not considered because the study specifically focused on navigational processes and behavioral outcomes in the high-choice environment of the news aggregator.

As independent variables we coded the prominence of all six news cues for every news item: presence of a picture, source credibility, position, length, number of related articles, and recency (Figures 2 and 3 and Appendix 2). The credibility level of all 80 news items was rated by students in an additional survey (for details, see Appendix 2).

Second, news factors were coded dichotomously. The coding of news factors was in line with Eilders (1997, 2006), who argues that news factors can be seen as collective relevance indicators. Four news factors were coded for every news item (Appendix 2). The reliability of the news factors coding was similar to other studies (e.g., Weber 2014; Wendelin, Engelmann, and Neubarth 2017). Since the topic of a news item has been shown to be a relevant news characteristic for selection processes (Wendelin, Engelmann, and Neubarth 2017), we also measured a news item's topic as a control variable and coded it as either political or non-political topic (Appendix 2).

Data Analysis

To test our hypotheses, we conducted several regression analyses (all models and results are reported in the Appendix). Hypotheses including news attention as the dependent variable (H1a-d, H3a) were tested using negative binomial regressions (NBR) with maximum likelihood estimations. NBR has been shown to be a suitable way to investigate empirical count data (Cameron and Trivedi 1998). A possible impact of news factors on

selective exposure (H2a-d) and on the presence of individual news cues (H4) was tested with logistic regression models. Possible indirect effects of news factors via news cues on selective attention (H5a) and on selective exposure (H5b) were estimated by calculating path models in R version 3.6.1 using the lavaan package (Rosseel 2012). Since the dependent variables in the path models are an asymmetric categorical variable (selective exposure) and a metric count variable (selective attention), we used robust maximum likelihood estimation (MLR). MLR is recommended in the case of violations of normality assumptions (Muthén and Muthén 1998-2007) and has lower Type I error rates with asymmetric data than WLSMV (Sass, Schmitt, and Marsh 2014).[1]

The fit of the path models was evaluated using the chi-square test and fit indices with cut-off values recommended by Hu and Bentler (1999): comparative fit index (CFI) value close to .95, root mean square error of approximation (RMSEA) lower than .06, and standardized root mean square residuals (SRMR) lower than .08.

Results

We assumed that news with power elite, prominence, proximity, and conflict receives more selective attention (H1a-d) and is more likely to be selected by users than news without these news factors (H2a-d). A negative binomial regression shows that none of the four news factors has a significant direct effect on selective attention, which contradicts our first four hypotheses (Appendix 3: Model 1). Moreover, a logistic regression model reveals conflict as the only news factor that predicts the likelihood of selective exposure ($p < .05$, OR = 1.98) (Appendix 6: Model 1). However, this effect of conflict on selective exposure disappears when the news cues are included in the model (Appendix 6: Model 3). Thus, there is no support for H2a-d.

To test whether news items with news cues receive more selective attention on Google News than results without news cues (H3a), we regressed news attention on the news cues (Appendix 3: Model 2). The model shows mixed results, with only the position cue ($p < .001$, IRR = 1.42) and the news length cue ($p < .001$, IRR = 2.08) as significant predictors for selective attention. Using a summed index of news cues as a predictor for news attention ($p < .01$, IRR = 1.26), we find support for H3a, and show that news with a higher number of prominent news cues is more likely to get users' attention (Appendix 3: Model 4). A logistic regression model was calculated to investigate the relationships between news cues and selective exposure (Appendix 6: Model 2). The model shows that if the related article cue is more prominent, the probability of selective exposure increases ($p < .001$, OR = 102.73). A second model regressing selective exposure on the news cue index supports H3b, showing that the prominence of news cues increases the likelihood of a news item being clicked by 178 percent ($p < .001$, OR = 2.78) (Appendix 6: Model 4).

H4 assumes that news factors affect the prominence of news cues in a news item. The hypothesis was tested with six logistic regressions, each of which inspected whether news factors predict the prominence of a single news cue as the dependent variable (picture, recency, related articles, position, news length, source), while controlling for the news item's topic (Appendix 7: Models 1-6). In line with H4, it was shown that different news factors increase the level of news cues on Google News.[2] Proximity increases the odds of the picture cue being present ($p < .01$, OR = 1.61) and is associated with longer news

items ($p < .01$, OR = 1.32) and with a higher likelihood of a credible source ($p < .05$, OR = 1.49). Moreover, news items containing conflict are more likely to have related articles ($p < .01$, OR = 2.17), a high position on the results page ($p < .01$, OR = 1.63), and originate from sources with higher credibility ($p < .01$, OR = 1.79). If news contains prominence, the odds of recency increase by 42 percent ($p < .05$, OR = 1.42), of a high position by 65 percent ($p < .01$, OR = 1.65), and of high source credibility by 63 percent ($p < .05$, OR = 1.63). The news factor power elite has a positive impact on the position cue ($p < .001$, OR = 1.86), but a negative impact on the source cue ($p < .05$, OR = 0.58). Thus, the odds for a high position increase by 86 percent if power elite is present in the news item, while the likelihood of a credible source decreases by 42 percent for news items with power elite.

As illustrated in Figure 4, we assume that the relationships between news factors and the dependent selection variables are mediated via the prominence of news cues. Since there are no direct effects of news factors on news attention and only one direct effect of conflict on selective exposure, a full mediation through news cues was expected.[3] We allowed correlations between the news cues during model specification. The news topic was included as a control variable and predictor for all seven endogenous variables (mediators and dependent variables) and could correlate with the news factors.

The path model exhibits good fit (χ^2 (10, $N = 751$) = 21.476, $p < .05$, CFI = .991, RMSEA = .039, SRMR = .023) and reveals five significant paths (see Appendix 8).[4] The position cue mediates the relationship between selective attention and the three news factors conflict ($\beta = .015$, $p < .05$), prominence ($\beta = .015$, $p < .05$), and power elite ($\beta = .017$, $p < .05$). There is also an indirect effect of prominence via the news length cue on selective attention ($\beta = .024$, $p < .05$). The four indirect effects of news factors via news cues on news attention support H5a. Regarding possible mediation effects for the relationship between news factors and selective exposure (H5b), we found a significant indirect effect of conflict via related articles ($\beta = .074$, $p < .05$), which partially supports H5b. Following the additivity hypotheses of news value research (Galtung and Ruge 1965) and the heuristic systematic model of information processing (Chen and Chaiken 1999), we tested for indirect effects of a sum index of news factors through a sum index of news cues on both dependent variables. The model exhibits good fit (χ^2 (2, $N = 751$) = 0.100, $p = .951$, CFI = 1, RMSEA < .01, SRMR < .01). The indirect effects of news factors via news cues on selective attention

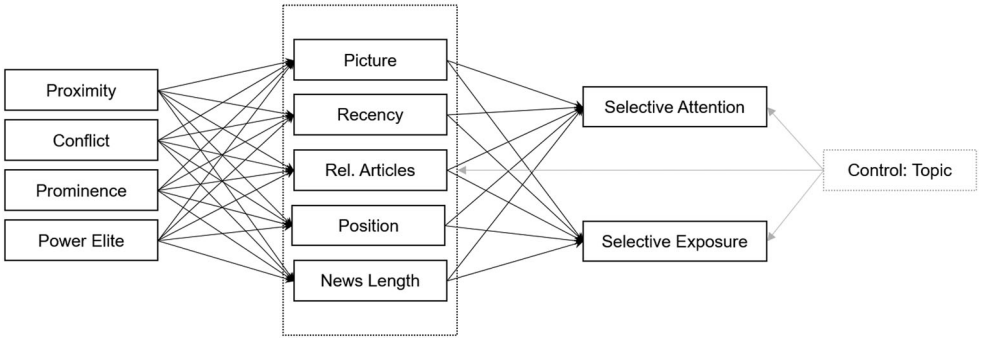

Figure 4. Path model for indirect effects of news factors via news cues on selective attention and selective exposure.

Table 1. Significant direct and indirect effects of news factors on selective attention and selective exposure in the path model.

	Selective Attention		Selective Exposure	
	Direct	Indirect Effect	Direct	Indirect Effect
Proximity	--	--	--	--
Conflict	--	via position cue	--	via related articles cue
Prominence	--	via position cue, via news length cue	--	--
Power elite	--	via position cue	--	--
News factor index	--	via news cues index	--	via news cues index

($\beta = .060$, $p < .001$) and on selective exposure ($\beta = .093$, $p < .001$) were found to be significant (see Appendix 10).[5]

The results from the path models show that news factors on news aggregators do not affect users' news attention and selective exposure directly; instead, their effects are mediated via different news cues (Table 1).

Discussion

The study examined users' news attention and news selection on a news aggregator website. In particular, we analyzed direct and indirect effects of news factors mediated via different types of news cues on selective attention and selective exposure on Google News. The results show no direct effects of news factors on news attention. Consequently, it is even less likely compared to newspaper readers that users of a news aggregator first read all headlines and then pay more selective attention to headlines with many or more prominent news factors. Previous research in traditional media contexts has shown that the relationship between news factors and news selection is partially mediated via formal cues. In high-choice media environments, however, these partial mediations become full mediations, as the results of this study indicate.

The results have implications for our traditional view on the role of news values and for the application of the news value theory to algorithmic platforms. The news value theory assumes that users can rely upon journalists' selection and news presentation decisions (size, position, layout) to identify news with greater collective relevance. When users access news not via traditional journalistic media (newspapers, TV, news websites) but rather via alternative channels (news aggregators, social media), non-journalistic news providers assume the function of highlighting relevant news, reducing the influence of journalism. Still, applications of the news value theory to news selection on algorithmic platforms require knowledge about the platforms' selection and ranking criteria. Unless one knows the relevance criteria applied by providers like Google News, the news value theory's potential to explain the work of news aggregator websites is limited. Thus, we can neither reason how changes in news websites' selection and ranking decisions affect Google News' algorithmic news selection nor interpret the degree of overlap between journalists' and news aggregator websites' strategies to guide user attention.

From a user perspective, our results have various implications for the news value theory. On the one hand, the lack of direct effects challenges the assumption of collectively shared relevance criteria in high-choice media environments. Fragmented news

use in high-choice media environments may reduce users' shared media socialization and the chance that people develop common relevance criteria. In this case, the news value theory would be outdated, and users' news selection would be better explained by individual users' relevance criteria, as described by the information utility approach (Knobloch-Westerwick 2015). However, if we consider indirect news factor effects, neither most studies (Fletcher and Nielsen 2017) nor our findings support the idea of increased audience fragmentation. The significant indirect effects of news factors suggest that young users in high-choice media environments collectively share algorithmic relevance criteria and professional journalistic relevance criteria. As long as news aggregators integrate both types of relevance criteria, users have the opportunity to form individual opinions about relevant societal issues on these platforms.

The study also has practical implications for news production and consumption. Newsrooms can track and analyze articles which attract users from other websites, including users who access content via Google News. Journalists' monitoring of audience preferences may result in a (further) shift in editorial news production from journalistic relevance criteria towards audience relevance criteria. From a normative perspective, this tendency becomes the more critical the less audience's and journalists' relevance criteria overlap. For news consumption, the study indicates that users on news aggregator websites rely primarily on news cues provided by the website. The position cue particularly attracts users' attention towards news items. Since this cue is well predicted by news factors, users of news aggregator websites can see journalistically relevant news at a high position. Assuming, that this event was covered by different media outlets. If an event is only reported by a single news outlet, as it is often the case for investigative news reports, the news item is presented in a less prominent position. Accordingly, we see a risk that this form of reporting, which is vital for the media's control function, is not sufficiently noticed among users of use news aggregators.

Altogether, these perspectives provide a mixed picture on the role of news value theory in high-choice media environments. The results indicate that the traditional idea of an event's newsworthiness continues to play a role on news aggregator websites. News decisions by media organizations (and their audiences) are partially reflected by media cues on a news aggregator. Users who visit a news aggregator website are more often redirected to journalistic news websites than those who do not use news aggregators (Calzada and Gil 2020). Still, one cannot assess the degree to which journalistic relevance criteria are incorporated into the news aggregator's algorithms and which other relevance criteria of news aggregators may conflict with journalistic relevance attributions. News aggregators' design decisions can favor some news factors, and thus also place certain topics more prominently than others. In addition to a popularity and source bias (Haim, Graefe, and Brosius 2018), this would also imply a coverage bias at the media content level. Finally, the collective relevance assigned to information, as assumed in news value theory, can decrease if media socialization is more individualized due to the presence of many high-choice news environments and fragmented media use.

In interpreting the findings and their implications, different limitations should be considered. First, the study examined specific news factors that have been confirmed in previous research. However, it is possible that other news factors or contextual factors of the website might affect users' news selection processes. Moreover, future studies should investigate why some news factors and news cues are (more) correlated and

others are not. This would allow for a deeper look into news aggregators' algorithmic news selection.

Second, an eye tracking field study was conducted. Thus, there was less variance in news attention, because we only coded a news item when users' attention was drawn to it for at least one millisecond. This decision was made to ensure that users paid a minimum amount of attention to a news item. Moreover, 80 percent of the news items that were coded had high source credibility. Even though users may have judged the news source, it is possible that this judgement was made through peripheral vision. Since the eye tracker only records the center of our visual gaze, this peripheral vision would not be recorded by the eye tracker and the dwell time variable. It is likely that other cues such as news length are stronger associated with the dwell time as an attention measure. However, it could also mean that the news aggregator primarily selects news items that have high source credibility. In a next step, it would be necessary to also include news that did not receive users' attention to compare characteristics of perceived and not-perceived news. The study only considered specific stages of news selection processes: attention and selective exposure. Future research should analyze psychological processes that are relevant for attention on a news aggregator, the depth of individual information processing, and their consequences for overt clicking choices in more detail.

A third limitation is that we collected data from a homogenous student sample. Relying on data from a young and more highly educated sample has implications for the generalizability of our results. Regarding an age effect, one may assume that the effects of news and technology cues are stronger among younger users. As stated by Sundar (2008, 75) "[c]ues […] of digital technologies are likely to be particularly salient to today's youth." Eilders (1997) also showed that higher education increases the selection of news from high-quality newspapers. Users' tendency to select news items with high source credibility might also be caused by the high level of education in our sample. It is unclear how possible age and education effects are related to the indirect effects of news factors on news selection processes. Therefore, future research on the subject should consider larger and more heterogeneous samples.

Finally, the study was conducted in 2015. The platform design has changed in the meantime, and weekly use of Google News has increased in countries such as France (+9%), Japan (+9%) and the US (+3%; Newman, Levy, and Nielsen 2015; Newman et al. 2020). The new design of Google News offers users a simpler website structure that lists fewer news items for each topic and provides users with a "View Full Coverage" option to search for more related articles. News items consist of a headline, a link, and one picture for each topic, but no longer have news texts. Accordingly, the headline remains as the only text-based option for users to identify news factors for a news item. This implies an even higher relevance of news cues as mediators of news factors' effect on users' news selection processes on news aggregator websites. The exclusion of news texts could mean that the effect of the news length cue has declined, whereas other news cues like position, source, or recency may have become more important.

This study is the first to indicate that the traditional idea of newsworthiness based on professional journalistic norms continues to play a role for users' news attention and selection on news aggregator websites, particularly in situations where users' news use does not have a specific goal. However, this relationship is mediated by specific news cues for the news aggregator and its underlying algorithmic relevance criteria.

Notes

1. Authors also suggest to use the WLSMV estimation for models with categorical data (Beauducel and Herzberg 2006). Therefore, we calculated the same model with WLSMV estimation to check for differences between the MLR and WLSMV models (Appendix 9). Differences between the two models are discussed in endnote 4.
2. This was also confirmed by an OLS regression model which regressed a sum index of news cues on the news factors (Appendix 5). In this model, proximity ($\beta = .08$, $p < .05$), conflict ($\beta = .12$, $p < .01$) and prominence ($\beta = .15$, $p < .001$) have positive effects on the news cues index.
3. Because conflict is the only news factor that had a direct effect on selective exposure (see logistic regression for H2d), we estimated a second path model which, besides all other effects, also included a partial mediation of the relationship between conflict and news selection via news cues. This model exhibits an appropriate fit (χ^2 (9, $N = 751$) = 20.530, $p < .05$, CFI = .991, RMSEA = .041, SRMR = .023), but no direct effect of conflict on selective exposure ($p = .35$).
4. Four out of these five significant paths were also confirmed using the WLSMV estimation (Appendix 9). Two of the three fit indices also suggest an appropriate fit between the model and the data (χ^2 (11, $N = 751$) = 35.422, $p < .001$, CFI = .995, RMSEA = .054, SRMR = .296), which confirms the results from the MLR estimation. The only effect that obtained a significant result with MLR but not with the WLSMV estimator was the mediating effect of the news length cue.
5. The fit between the model and the data was also given when estimated with the WLSMV estimator (χ^2 (2, $N = 751$) = 0.058, $p = .971$, CFI = 1, RMSEA < .01, SRMR < .01). The WLSMV model confirms both indirect effects.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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